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CONTAMINANTS PROGRAM

**FIELD TEST OF BIOLOGICAL
CONTROL METHODS TO CURTAIL
EXOTIC PLANTS ON NATIONAL
WILDLIFE REFUGES IN MONTANA**

by

Bill Olsen, William L. West and Lynn Clark

**FISH AND WILDLIFE SERVICE
Ecological Services
Montana Field Office
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- 2) field test biological control methods, which may include the release of natural enemies such as insects, fungi, and specific plant diseases to curtail noxious weeds infesting habitats managed by Service staff at the National Bison Range (NBR), Moiese, Montana.

METHODS

Locations of infestations of St. Johnswort, Dalmatian toadflax, spotted knapweed, musk thistle, and Canada thistle on the NBR were identified. Refuge personnel mapped the distribution of St. Johnswort on the NBR each fall in 1991 and 1992 and determined the acreage infested and the density of plants within infested areas. In consultation and in cooperation with experts from the Plant Pathology Department and Agricultural Extension Service at Montana State University, a pilot project was developed to introduce parasitic pathogenic organisms on selected exotic plant sample plots at the NBR. The success of the introductions was monitored by evaluating the viability of the control agent(s) within the sample plot over time and the aerial extent of the target weed under a range of field conditions.

We established seven Parker 3-step vegetation transects (Parker 1951) to monitor the efficacy of the insect releases (Table 1). Three measurements were made at appropriate distances along 100-foot line transects established between permanent markers: (1) vegetation type at 1-foot intervals, (2) total number of target species plants intercepted, and (3) canopy cover of the largest species intercepted. Monitoring will continue on a biennial basis.

RESULTS AND DISCUSSION

Eight species of insects adapted to exploit six host species of exotic plants were released on Service lands (Figure 1) managed by the NBR in 1991, 1992, and 1993 (Table 1). Long-term success of the releases cannot be predicted. Releases of at least one species resulted in successfully over-wintering populations, but reductions in the host plants are not yet obvious.

C. lunula is known to have over-wintered successfully after release, but its host plant, Dalmatian toadflax, was more abundant on the monitored sites after release than before. In 1993 C. lunula was found on a small (two square feet) patch of Dalmatian toadflax at the Johnson Waterfowl Production Area, at least six miles from the closest release site. Apparently this insect is able to find very isolated plants at great distances from the original release site, enabling C. lunula to persist and effect an impact on Dalmatian toadflax.

Releases of A. plagiata, V. cardui, and G. californiensis have resulted in successful establishment, and their host plants were damaged and/or reduced in abundance after their release. Acreage and density of St. Johnswort infestations on the NBR were much reduced in 1992 (Table 2).

No releases of St. Johnswort biocontrol agents were made in 1991 or 1992, so the reduction was apparently due to cyclic increases of Chrysolina hypericum

and Chrysolina quadrigemina, previously established in 1948, and to Agrillus hyperici released in the 1950's and only recently re-observed on the NBR. St. Johnswort populations have been monitored from 1985-1993, excepting 1987. These monitoring results indicate cyclical control. Photo points established in 1989 are to be revisited in 1995.

We do not know that the observed damage to exotic plants was due entirely to the action of the introduced biocontrol agents, rather than abiotic factors. However, the observed association of damage to individual plants with insects established on those individual plants leads us to believe that some biocontrol agents are successfully controlling the spread of their hosts.

CONCLUSIONS AND RECOMMENDATIONS

Biological control methods employed on the NBR have been modestly successful. The most significant reductions of exotic plants in Montana have occurred where multiple species of pathogenic organisms have become established (Story et al. 1987). That level of control has not yet been achieved for most species of exotic plants on the NBR. Releases of biocontrol agents should be continued until sufficient populations are established to effect control of the plants. Other components of the IPM system employed at the NBR should be evaluated as the biocontrol component has been in this study.

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Table 1. Biological control agents released on the National Bison Range, its satellite Refuges, and its WPA's in 1991, 1992, and 1993. The number of transects represents the number of Parker 3-step monitoring transects (of which there were 7) on which each organism occurred.

Noxious weed	Biological control agent	Number of individuals released			Number of Transects
		1991	1992	1993	
St. Johnswort	<u>Aplocera plagiata</u>			400	
Dalmatian toadflax	<u>Calophasia lunula</u>	200	300	500	3
Spotted knapweed	<u>Agapeta zoegana</u>	171	454	300	4
	<u>Cyphocleonus achates</u>		44	308	3
Canada thistle	<u>Larinus planus</u>			300	
	<u>Urophora cardui</u>		?		
Musk thistle	<u>Trichosirocalus horridus</u>		?	200	
Purple loosestrife	<u>Galerucella californiensis</u>			100	

Table 2. Success of biological control agent releases on the National Bison Range, its satellite Refuges, and its WPA's in 1991, 1992, and 1993.

Noxious weed	Biological control agent	Agent ^A estab- lished	Weeds damaged
St. Johnswort	<u>Aplocera plagiata</u>	Yes	Yes
Dalmatian toadflax	<u>Calophasia lunula</u>	Yes	Yes
Spotted knapweed	<u>Agapeta zoegana</u>	?	No
	<u>Cyphocleonus achates</u>	?	No
Canada thistle	<u>Larinus planus</u>	?	No
	<u>Urophora cardui</u>	Yes	Yes
Musk thistle	<u>Trichosirocalus horridus</u>	?	Yes
Purple loosestrife	<u>Galerucella californiensis</u>	Yes	Yes

^A We considered an agent to be established if it overwintered and reproduced successfully on the NBR.

Table 3. Acreage of St. Johnswort infestations assigned to three density classes on the National Bison Range during 1991 and 1992.

Density class	Acreage infested	
	1991	1992
Light	2,042	1,374
Moderate	1,917	904
Heavy	1,203	194
Total	5,162	2,472

Figure 1. Biocontrol agent release sites on the National Bison Range.

